भारतीय मानक
Indian Standard

IS 12469 : 2019

अचल अग्निशमन प्रतिष्ठान के लिए पंपों की विशिष्टि

(पहला पुनरीक्षण)

Specification of Pumps for Stationary Fire Fighting Installations

(First Revision)

ICS 13.220.10

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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May 2019 **Price Group 5**

Pump Sectional Committee, MED 20

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pumps Sectional Committee had been approved by the Mechanical Engineering Divisional Council (MEDC).

This Standard was first published in 1988. Experience gained in implementation of this standard necessitates this revision and certain changes that are necessary have been incorporated. In the first revision of this standard all amendments have been reviewed and incorporated and due importance has been given to energy conservation and safety.

The major changes in this revision are as follows:

a) Clause **3.1.1** to **3.1.7** have been deleted considering that the subject matter of these clauses actually refers to selection of capacity ratings of pumps, based on risk level or grade of hazard;

b) Nominal capacity-ratings have been given in litres per minute (l pm);

c) All FPS system units have been substituted by metric units; and

d) Reference for flanges of pumps have been replaced by corresponding Indian Standards, in place of ANSI Standards.

The composition of the Committee, responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standards.

Indian Standard

SPECIFICATION OF PUMPS FOR STATIONARY FIRE FIGHTING INSTALLATIONS

(First Revision)

1 SCOPE

This specification covers technical requirements of centrifugal pumps for fire fighting intended for installation in and around buildings/industrial plants.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are advised to investigate the possibility of applying the most recent editions with the latest amendments of the relevant Standards.

3 TERMINOLOGY

Terminology relating to pumps as specified in **3** of IS 5120 shall be applicable. In addition, the following shall also apply.

3.1 Corrosion Resistant Material — These are metallic materials having resistance to corrosion due to raw water, equal to or better than that of copper alloy having minimum copper content of 80 percent.

3.2 Total Head

3.2.1 For a split case or end suction pump, total head is the algebraic difference in kPa between pressures as measured at the discharge flange and the suction flange, corrected to the pump centre line and corrected for changes in velocity head at the points of gauge attachment.

3.2.2 For a vertical turbine pump, the total head is the reading of a pressure gauge attached just beyond the discharge flange of the pump in kPa and corrected for the vertical distance from the water level to the centre of the gauge and for the frictional losses encountered in the piping between the uppermost bowl and the point of attachment of the gauge and also corrected for velocity head at the point of pressure gauge.

3.3 Shut-Off Head — The total head developed by a pump at rated speed with delivery valve fully closed.

3.4 Types of Pumps

3.4.1 *End Suction Pumps See Fig. 1 for Pump Type OH1 in IS 15657* — A horizontal centrifugal pump with suction nozzle axis in line with pump shaft axis and position of nozzle opposite to the stuffing box side of the casing. It is intended that these pumps shall be used on a static suction lift condition only if a special provision for automatic priming of the pump is available. These pumps may have one or more stages.

3.4.2 *Split Case Pump See Fig. 7 for Pump Type BB1 in IS 15657* — A horizontal centrifugal pump characterized by a casing which is split along a plane containing the axis of rotation. It is intended that these pumps will be used on a static suction lift condition only if a special provision for separate priming source for the pump is available. These pumps may have one or more stages/impellers.

3.4.3 *Vertical Turbine Pump See Fig. 12 for Pump Type VS1 in IS 15657* — Specifications for pumps of this type are also detailed in IS 1710, except that the ratings, constructional features, design requirements, requirements of materials, testing and acceptance criteria shall all be in conformance to this standard.

3.4.4 *Multistage Pump See Fig. 9 and 10 for Pump Types BB 3 and BB 4 Respectively in IS 15657* — In these umps the total head is developed by more than one impellers.

3.4.5 *Inline Pumps — See* Fig. 3, 4, 5, 6 for Pump Types OH3, OH4, OH5 and OH6 in IS 15657.

3.5 Maximum Power Input at Pump-shaft — It is the maximum power required by the pump at the rated speed and at any capacity within the operating range of the pump. For the purpose of this standard, operating range would be from 0 flow to 150 percent of the rated flow.

4 GENERAL REQUIREMENTS

4.1 Standard Capacities

Ratings of flow rates for pumps shall be one or more of the following values in liters per minute (l pm) 95, 189, 379, 568, 757, 946, 1136, 1514, 1703, 1892, 2839,

3785, 4731, 5677, 7570, 9462, 11355, 13247, 15140, 17032 and 18925.

4.2 Castings

Castings shall be smooth, free from scales, lumps, cracks, blisters, sand holes and defects of any nature which could make them unfit for the use for which they are intended. A casting shall not be salvaged by filling or plugging; however, impregnation may be employed to remove porosity.

4.3 Fasteners

Fasteners exposed to corrosion shall be of corrosion resistant material.

5 CONSTRUCTIONAL REQUIREMENTS

5.1 General

5.2 An end-suction or in-line pump shall be of a single or two stage construction. A split case pump may be of a single stage or multi stage construction. A vertical turbine pump may have any number of bowls and impellers.

5.3 A split case, vertical turbine, end suction, or in-line pump shall have a rated capacity equal to the value specified in **4.1**.

5.4 A casting shall be smooth and free from scale, lumps, cracks, blisters, sand holes, and defects of any nature that may affect the use for which it is intended. A casting shall not be plugged or filled, but may be impregnated to remove porosity.

5.5 A bolt, stud, cap screw, or gland swing bolt used to assemble parts subject to stress due to water pressure shall not be less than 3/8 inch (9.5 mm) in diameter.

5.6 An interior bolt or screw that is exposed to pumped fluid shall be of rolled bronze or other corrosion-resistant material.

5.7 The maximum stress on any bolt of a pressure containing joint shall not exceed one-fourth the elastic limit of the material as computed by using the stress area. The stress area is the area at the basic minor diameter of the external thread as detailed in IS 4218 (Part1).

The basic minor diameter of the external thread shall be computed by the following equation:

$$d_1 = D - 1.0825 \times P$$

Where,

d_1 = is basic minor diameter of the external thread, in mm;

D = is Nominal diameter of thread, in mm; and

P = is nominal pitch of thread, in mm.

The load on the bolts is to be computed on the basis of the water pressure equivalent to the maximum working pressure acting over the area bounded by circle or profile through the centers of the bolts.

5.8 The maximum combined shear stress for a pump shaft shall not exceed 30 percent of the elastic limit in tension or be more than 18 percent of the ultimate tensile strength of the material of shaft. Compliance with this requirement is to be verified by a review of manufacturers' stress calculations.

5.9 The impellers shall be dynamically balanced to the **G 6.3** balance quality grade in accordance with the requirements for pump-impellers in IS/ISO 21940-11 for 'Mechanical vibration — Rotor balancing: Part 11 Procedures and tolerances for rotors with rigid behaviour'.

NOTE — The impellers may be statically (single plane) balanced in accordance with IS/ISO 21940-11 : 2016 if the ratio of the maximum outside diameter to the width at the periphery (including the shroud but not including the back vane) is equal to or greater than 6.

5.10 Flange dimensions and bolt layouts used in pipe connections shall comply with the requirements of one of the following standards:

a) IS 3516 Cast iron pipe flanges;
b) IS 9523 Ductile iron fittings; and
c) IS 6392 Steel pipe flanges.

NOTE — A pump intended for use in installations where the connection piping has pipe flange dimensions that are different from the above standards shall be permitted to be constructed with flanges complying and compatible with connection piping.

5.11 All threaded openings used for pipe connection shall comply with the requirements specified in IS 554.

NOTE — A pump intended for use in installations where the connected piping has pipe threads that are different from the above, shall be permitted to be constructed with threads complying and compatible with the connected piping.

5.12 A pump shall be provided with the following:

a) Automatic air-release valve (not required for self-venting pumps);
b) Circulation relief valve (except for engine driven pumps for which engine cooling water is taken from the pump discharge); and
c) Pressure gauges.

5.13 The minimum internal dimensions of the passages at any point in the impeller shall not be less than:

a) 7.9 mm for a pump rated 1893 l pm or less; or
b) 12.7 mm for a pump rated more than 1 893 l pm.

6 DESIGN REQUIREMENTS

6.1 Pump Casing

The pump casing shall be axially split or radially split. Pumps with radially split casing shall have back pullout

features to permit examination of impeller(s) and other interior parts without disturbing suction or discharge piping.

6.2 A drain opening shall be provided so that all the water in pump casing can be drained. Minimum size of drain shall be Nb 15 mm, as specified in IS 554.

6.3 Wearing Rings and Other internal Components

6.3.1 Impellers and wearing rings shall be of corrosion resistant material. Shaft sleeve, sealing cage, gland, gland nut and drain plug shall be of corrosion resistant material.

6.3.2 Manufacturing tolerances of mating dimensions shall ensure such running clearance that there shall not be any rubbing contact between the mating dimensions.

6.4 The impeller(s) shall be secured in an axial direction preventing contact with the casing under operating conditions.

6.5 Shaft(s)

Shaft(s) shall be of stainless steel or of carbon steel with corrosion resistant shaft sleeve(s) at stuffing boxes.

6.6 The sleeve bearings in axially split casing pumps shall be accurately machined to achieve uniform cylindrical fits and shall be replaceable.

6.7 Water deflectors of corrosion resistant material shall be provided to protect the bearings from any incidental leakage at stuffing box (es).

6.8 Antifriction Bearings

6.8.1 Antifriction bearings shall be designed to have a minimum L10 life (basic rating life) of 5 000 h under maximum operating conditions.

6.8.2 *Shaft Sealing Arrangement*

The shaft shall be provided with a sealing arrangement consisting of a stuffing box having adequate depth to accommodate minimum 5 rings of gland packings and a seal cage. The gland shall exert a uniform pressure on the packings. If stuffing box is provided at the suction side of the pump, it shall be water sealed.

6.9 Flexible Couplings

The pump shaft and drive shaft shall be connected by suitable type of flexible coupling. Coupling guard shall be provided to cover rotating flexible coupling.

7 VERTICAL TURBINE PUMPS

7.1 The rated speed of vertical turbine pumps shall not exceed 2 100 rpm.

7.2 Vertical turbine pump shall be suitable to be driven either by electric motor having a vertical solid or hollow shaft or by an internal combustion engine to be connected via a right angle gear drive.

7.3 Discharge Heads

7.3.1 The discharge head may be of either the above (surface) ground type or the underground type.

7.3.2 The discharge head shall support the driver, the pump column assembly and the oil tube tension nut or stuffing box.

7.4 Pump Column

The column for a pump shall be furnished in sections not exceeding a nominal length of 3 m. It shall be of material and thickness specified in IS 1710.

7.5 Bowl Assemblies

Pump bowl shall be provided with bronze wearing ring of composition dissimilar to that of the impeller.

7.6 Impeller(s)

7.6.1 Impeller shall be of suitable corrosion resistant material.

7.6.2 Impeller(s) shall be statically and dynamically balanced and securely fastened to the impeller shaft. Impeller shall not contact the bowl under operating condition.

7.6.3 A suitable mechanism to adjust the axial position of the impeller(s) with respect to the bowl(s) shall be provided.

7.6.4 Water passages shall be designed to minimize the possibility of foreign materials being lodged in them.

7.7 Impeller Shafts

The impeller shafts shall be of stainless steel of grade 04Cr13 of IS 6527.

7.8 Line Shafts

7.8.1 Line shafts of water lubricated type pumps shall be stainless steel (grade 04Cr13 of IS 6527) or of carbon steel with corrosion resistant shaft sleeves at bearings and at stuffing boxes.

7.8.2 The line shafts of oil lubricated type pumps shall be of carbon steel or material having equivalent strength and rigidity.

7.8.3 The computed; sheer stress in shafting shall not exceed 30 percent of the yield strength of 18 percent of the ultimate tensile strength, whichever is lower.

7.9 Line Shaft Couplings

The line shaft sections shall be connected by a threaded coupling or a muff or a sleeve coupling.

7.10 Line Shaft Bearings

7.10.1 Water lubricated line shaft bearings shall consist of cutless rubber moulded in corrosion resistant metal shells.

7.10.2 When the static water level exceeds 15.2 m below ground level oil lubricated pump shall be used.

7.10.3 Oil lubricated line shaft bearings for the enclosed line shaft shall be of corrosion resistant material.

7.11 Shaft Enclosing Tube

It shall be of adequate size and shall conform to the requirements specified in IS 1710.

7.12 Oil Lubrication to Line Shaft Bearings

An automatic lubricator shall be installed for electric motor driven pumps and other type of lubricator for engine driven pumps.

8 PERFORMANCE OPERATION TEST, HYDROSTATIC STRENGTH TESTS, MANUFACTURING AND PRODUCTION TESTS

8.1 Performance Operation Test

8.1.1 Performance characteristic shall be of the continuously rising type. Pump shall be designed to meet one or more of the rated capacities given in **4.1**.

8.1.2 Rated net pressures shall be 2.8 kg/cm2 or higher.

8.1.3 A pump shall develop not less than 65 percent of rated total head when delivering 1.5 times the rated flow rate.

8.1.4 Nature of curve for Power versus Flow-rate shall be of non-overloading type.

8.1.5 For the tests described in **8.1.6** to **8.1.9**, the applicable level of test tolerances as specified in the IS 9137 shall be utilized. The hydraulic performance test shall be permitted to be conducted at a speed within 20 percent of the rated speed, and the performance curves for the rated speed shall be determined as detailed in IS 9137.

8.1.6 In case of vertical turbine pumps, the maximum net pressure shall not exceed 140 percent of rated head. In case of the end suction, split case, multistage and inline type pumps, the shut-off head shall not exceed 120 percent of the rated head.

8.1.7 During the hydraulic performance test readings will be noted for total head developed at shutoff, at rated capacity, at 150 percent of rated capacity, and at selected intermediate capacities between shutoff and maximum capacities exceeding 150 percent of rated capacity. Performance curves shall be plotted showing the total head, efficiency and power input to pump (kW). The test shall be conducted with a positive suction pressure sufficient to show the maximum power input (kW) required by the pump.

8.1.8 A vertical turbine pump is to be tested with the least amount of submergence and the maximum bearing span intended for installation.

8.1.9 A split case, end suction, or in-line pump, or a vertical turbine pump provided with a suction vessel, shall also be tested at rated capacity and 150 percent of rated capacity with a water vacuum of 4.57 m at the pump suction flange (manometer location corrected to datum) at sea level and reduced by 1 mm for each 1 m of elevation above mean sea level (MSL).

8.1.10 The acceptable vibration limits of the train shall be as per its applicable standards and specifications except for reciprocating engines. In case of pump driven by reciprocating engines, the vibration limits shall be mutually agreed up on by purchaser, pump vendor and engine supplier.

8.1.11 If specified, the noise measurements shall be performed as agreed between the purchaser and the pump vendor.

8.2 Hydrostatic Strength Tests

8.2.1 The pump casing(s) of a split case, end suction, or in-line pump, the pump bowls, and the discharge heads of a vertical turbine pump, shall withstand for 1 min without rupture a hydrostatic pressure of twice the maximum working pressure or 27 kg/cm^2, whichever is greater. For a vertical turbine pump, the bowls tested are to include discharge bowls and intermediate bowls. Multistage pump shall be segmentally tested at the appropriate pressure.

8.2.2 The suction vessel (if applicable) of a vertical turbine pump shall withstand for 1 min, without rupture, a hydrostatic pressure of four times the rated maximum suction pressure or 27 kg/cm^2, whichever is greater.

8.3 Manufacturing and Production Tests

To verify compliance with these requirements in production, the manufacturer shall provide the necessary production control, inspection and tests. The program shall include at least the following:

8.3.1 Each pump is to be subjected to the tests specified in **8**, and shall comply with the applicable requirements given in **8.1.1-8.1.4**.

8.3.2 Each pump is to be tested hydrostatically for not less than 5 min. The test pressure is to be not less than 1.5 times the maximum working pressure of the pump, but in no case less than 17.2 kg/cm^2. There shall be no rupture or leakage through the castings at

the test pressure. For a vertical turbine pump, both the discharge head and pump's bowls are to be tested.

a) The impeller(s) of each pump shall be balanced in accordance with the requirement specified in **5.9**.
b) Records are to be maintained of all tests conducted.

8.4 Proof of Design Test

Split case pumps to be installed with shaft axis being vertical shall be subjected to an additional endurance test for 24 h at rated speed and rated capacity. During this test the bearings shall not exhibit wear as indicated by an increase in power required by the pump. The water shall not enter the lower bearings during running or standstill condition.

9 SELECTION OF DRIVE RATING

9.1 Motor Driven Pumps

Motor shall not get overloaded in the entire range of operation, that is, between zero capacity to 150 percent of the rated discharge.

9.2 Diesel Engine Driven Pumps

Engines, after correction for altitude and ambient temperature, shall have bare engine power rating equivalent to the higher of the following two values. 20 percent in excess of the maximum power required to drive the pump at its rated capacity or the power required to drive the pump at 150 percent of its rated capacity.

10 MARKING

10.1 Each pump shall be provided with a name plate of suitable size and made of corrosion resistant metal, securely attached to the pump and visible after installation.

10.1.1 For all pumps, the nameplate shall include the following information:

a) Manufacturer's name or identifying mark,
b) Rated capacity,
c) Rated speed,
d) Model or type designation,
e) Serial number,
f) Rated head,
g) Net head at 150 percent of rated capacity,
h) Number of stages,
j) Maximum power required at rated speed at any discharge condition,
k) Impeller diameter, and
m) A directional arrow shall appear on each pump indicating the direction of rotation.

11 BIS CERTIFICATION MARKING

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed there under, and the product(s) may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
554 : 1999	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
1710 : 1989	Pumps — Vertical turbine mixed and axial flow, for clear cold water (*second revision*)
3516 : 1966	Cast iron pipe flanges and flanged fittings for petroleum industry
4218 (Part 1) : 2001	ISO general purpose metric screw threads: Part 1 Basic and design profiles (*second revision*)
5120 : 1977	Technical requirements for rotodynamic special purpose pumps (*first revision*)
6392 : 1971	Steel pipe flanges
6527 : 1995	Stainless steel wire rod pumps (*first revision*)
9137 : 1978	Code for acceptance test for centrifugal, mixed flow and axial pumps — Class C
9523 : 2000	Ductile iron fittings for pressure pipes for water, gas and sewage (*first revision*)
15657 : 2006	Centrifugal pumps for petroleum, petrochemical and natural gas industries
IS/ISO 21940-11 : 2016	Mechanical vibration — Rotor balancing: Part 11 Procedures and tolerances for rotors with rigid behaviour

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Composition of Pumps Sectional Committee, MED 20

Organization	*Representative(s)*
Fertilizers and Chemicals, Travancore (FACT), New Delhi	Shri A. K. Nijhawan (***Chairman***)
Aquasub Engineering, Coimbatore	Dr C. Muthu Shri C. Murugesan (*Alternate*)
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Gail India Ltd, New Delhi	Shri Satish Geda
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International Copper Association India, Mumbai	Shri Abhishek Dhupar Shri Debdas Goswami (*Alternate*)
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Organization	*Representative(s)*
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The Southern India Engg Mfrs Assn, Coimbatore	Shri K. V. Kartik Shri D. Jayaprakash (*Alternate*)
Wilo Mather and Platt Pumps Ltd, Pune	Shri Manoj Bafna

COMPOSITION OF UTILITY AND INDUSTRIAL APPLICATION PUMPS SUBCOMMITTEE 20 : 6

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Best Engineers Pumps Pvt Ltd, Coimbatore	Shri S. Thangapandi Shri N. Ranadhive (*Alternate*)
Crompton Greaves Consumer Electricals Limited, Ahmednagar	Shri Pravin Garje Shri Parvin Murdekar (*Alternate*) Shri Rohit Kanase (YP)*
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Projects & Development India Ltd, Vadodara	Shri G. P. Dabi Shri R. C. Sharma

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Small Industries Testing and Research Centre, Tamilnadu	Shri E. A. M. Selvaraj
TATA Consulting Engineers, Bangalore	Shri S. V. Kamesh Shri R. Madhavan
The Southern India Engg Mfrs Association, Coimbatore	Shri K. V. Kartik Shri D. Jayaprakash (*Alternate*)
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Wilo Mather and Platt Pumps Ltd, Pune	Shri Manoj Bafna
Thyssenkrupp Industrial Solutions (India) Private Limited, Mumbai	Shri Suhas Shrirao Shri Rajesh Shekatkar

* Young Professionals.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: MED 20 (13090).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi